REMARKS:

1) The Examiner's attention is directed to the corrected Formal Drawings that were filed on September 6, 2003. That submission included three (3) Replacement Sheets with formal Figs. 1 to 3 thereon. Original formal Figs. 4 and 5 are maintained unchanged. Approval and entry of the corrected formal Figs. 1 to 3 are respectfully requested.

2) The Specification has been amended to correct a minor spelling error in the paragraph bridging page 3 und 4, without introducing any new matter. Entry of the amendment is respectfully requested.

3) The claims have been amended as follows:

Claims 1 to 23 and 31 to 35 have been cancelled.

Claim 24 has been amended into independent form by incorporated the subject matter of original claim 1, and a clarification by deleting the word "then" in original line 3. This is to achieve better conformance with some of the claims depending from claim 24, in which at least some of the mold closing motion must be carried out before introducing the substrate material (e. g. in the case of injecting a substrate material).

Claims 25 to 29 have been amended for proper conformance and dependence from claim 24.

Claim 30 is maintained unchanged.

New claims 36 to 61 have been added. The new claims are based on and supported by subject matter of the original claims and the original disclosure as shown in the following table, and do not introduce any new matter. Claim 36 (in comparison to claim 1) refers to a "skin film portion" and a "backing portion" rather than a "skin film" and a "foam backing" to make more clear that these two elements can comprise portions of the same polymeric material, or can be distinct layers of different materials that have been laminated together (see page 18, line 16 to page 19, line 7).

New Claims	36	37	38	39	40	41	42	43	44
Original Disclosure	cl. 1,2, 3,4, 12	cl. 4	cl .5	cl.6,30; p.20 l.20-24; p.22 l.11-p.23 l.14;	cl. 7	cl. 8	cl.6,30; p.20 l.20-24; p.22 l.11-p.23 l.14;	cl. 9	cl. 10

New Claims	45	46	47	48	49	50	51	52	53
Original Disclosure	cl. 11	cl. 15	cl. 16	cl. 17	cl. 18	cl. 19	cl.22; p.18, l.27	cl.21; p.19, l.2	cl.1,21; p.18, l.27-p.19, l.2

New Claims	54	55	56	57	58	59	60	61
Original Disclosure	cl. 20	cl. 21	cl. 22	cl. 23	cl. 24	cl. 28	cl. 29	p.8, l.20-21

Entry and consideration of the claim amendments and the new claims are respectfully requested.

4) Referring to s ctions 1 to 4 on page 2 of the Office Action, the election of the method claims 1 to 30 is hereby affirmed. After the present amendment, all of the present claims 24 to 30 and 36 to 61 are directed to and read on the elected method invention.

5) Referring to section 5 on page 3 of the Office Action, the rejection of claim 13 as indefinite has been obviated by the cancellation of claim 13. The subject matter of claim 13 is no longer being pursued in the present remaining claims.

6) Referring to section 9 on page 5 of the Office Action, the allowance of claim 30 is appreciated. Claim 30 has been maintained unchanged, and should still stand allowed.

7) Referring to section 10 on page 5 of the Office Action, the indication of allowable subject matter in original claim 24 is appreciated. Claim 24 has been amended into independent form, by incorporating the subject matter of original independent claim 1 with a minor correction as mentioned above. Accordingly, claim 24 and its dependent claims 25 to 29 should now be allowable.

8) Referring to sections 7 and 8 on pages 3 to 5 of the Office Action, the rejection of claims 1, 2, 15 to 23 and 29 as obvious over U. S. Patent 5,976,288 (Ekendahl), and the rejection of claims 3 to 12 and 14 as obvious over Ekendahl in view of U. S. Patent 3,676,537 (Winstead) have been obviated by the cancellation of those rejected original claims. These references

and the basis of the rejections will be discussed in connection with the new claims 36 to 61.

9) It is noted that new independent claim 36 incorporates features from original claims 1, 2, 3, 4, 12 and 14. Since original claims 3, 4, 12, and 14 had not been rejected based on Ekendahl alone, the new independent claim 36 could not be rejected based on Ekendahl alone. The combination of Ekendahl and Winstead proposed by the Examiner will be discussed below.

10) As more clearly set forth in new independent claim 36, the invention is directed to a method of making a molded component having a molded-in surface texture, including a combination of special method steps and features that distinguishes the invention over the prior art and also solve or avoid problems encountered by the prior art.

In order to form a clear detailed impression of a molded-in surface texture in a surface of a cover sheet, the invention calls for <u>not only softening but actually melting the surface film of the cover sheet into a melted viscous liquid state</u> and then molding the molded-in surface texture into the surface film while it is still in this melted state. However, if the entire cover sheet (rather than only the surface film portion) would be melted, it could no longer be handled, processed and molded as a sheet in the molding process.

For this reason, the inventive method calls for <u>deferentially heating the cover sheet so as to **melt a skin film portion** thereof into a melted viscous liquid state while</u>

<u>maintaining a **backing portion thereof in an elastic s lid state**</u>. Thus, at l ast the backing portion of the cover sheet remains as a coherent elastic solid material that can be processed and molded as a sheet. This solid backing portion of the cover sheet also supports the melted viscous skin film portion and keeps it from simply flowing or running away. Furthermore, the combination of a solid backing portion and a melted viscous skin film portion of the cover sheet also achieves significant advantages during the molding process as will be discussed below.

The inventor has found that <u>mechanical molding, blow molding, and vacuum molding are each individually not suitable for molding a cover sheet that has a melted viscous skin film portion and an elastic solid backing portion</u>. For example, mechanical molding cannot apply a sufficiently uniform molding pressure over the entire surface of the cover sheet for carrying out the uniform detailed impression of the molded-in surface texture into the surface of the cover sheet especially when that cover sheet surface is in a melted viscous liquid state. Also, the mechanical molding causes stretching and deformation of the cover sheet material during the molding, which would tend to smudge or smear the molded-in surface texture. Blow-molding using compressed air or the like would be too slow to maintain the skin film portion of the cover sheet in a melted viscous liquid state while molding the cover sheet and pressing the skin film portion against the textured mold surface. Also, blow molding would cause substantial stretching and distortion of the cover sheet, thereby smudging or smearing the molded-in surface texture. Vacuum molding is wholly unsuitable in the present

context, because a vacuum applied to the skin film portion in order to draw the cover sheet against the textured mold surface would suck the melted viscous liquid material of the melted skin film portion into the vacuum holes of the mold. This would form undesirable "pips" or nubs as defect in the molded-in surface texture of the finished cover sheet, namely with a "pip" or nub formed at each location where the melted skin film material was sucked into a vacuum hole of the mold.

The inventive method overcomes the above problems by combining a mechanical pre-molding step with a rapid pressurized gas molding step. Namely, claim 36 calls for a step c) in which a back mold surface mechanically pre-molds the cover sheet toward the front mold surface, but does not yet bring the cover sheet into contact with the textured front mold surface. Thereafter, claim 36 further calls for a step e) of introducing a **pressurized gas** into a gap between the back mold surface and the cover sheet to further **press the cover sheet toward the front mold surface** and thereby **bring the skin film portion into direct contact with the textured front mold surface**.

Thus, the mechanical mold closing motion of the back mold mechanically carries out most of the molding deformation of the cover sheet, while the introduction of the pressurized gas between the back mold surface and the cover sheet carries out the final small amount of molding of the cover sheet to press the skin film portion of the cover sheet against the textured front mold surface. This introduction of the pressurized gas into a relatively small gap between the back mold and the cover sheet is achieved quite rapidly, so that the contact of the cover sheet

with the textured mold surface is also carried out rapidly to form a clear impression of the textured mold surface in the skin film portion of the cover sheet.

Also, throughout the molding process, the backing porting of the cover sheet is still in an elastic solid condition, so that it can be molded while supporting the melted viscous skin film portion of the cover sheet. The skin film portion is at least partially still in the melted viscous liquid state when it is pressed into contact with the textured front mold surface by the introduction of the pressurized gas. Meanwhile, the solid backing portion acts as a buffer or bridging layer to spread out the pressure of the pressurized gas, and prevent the pressurized gas from "blowing through" the melted liquid skin film portion. Thereby, the molding (including a mechanical molding step) can be carried out as if working with a solid sheet of material, while also providing a detailed molded-in surface texture by quickly pressing the melted viscous liquid of the skin film portion of the cover sheet against the textured mold surface (with the pressurized gas molding step).

Furthermore, according of the inventive method, a vacuum is preferably not applied to the skin film side of the cover sheet until after the molded-in surface texture has been formed and at least partially cooled and solidified in the skin film portion (see e. g. dependent claims 39 to 42). The light vacuum merely serves to hold the cover sheet in a fixed position relative to the textured mold surface to avoid smudging or smearing or double-impressing the surface texture on the surface of the cover sheet. The light vacuum also serves to hold the cover sheet in

place against the front mold surface while the molds are opened for further processing or for subsequent removal of the molded cover sheet.

The above combination of steps and features avoids the disadvantages, and achieves improved results in comparison to the prior art. Such a combination of steps and features would not have been suggested by the proposed combination of Ekendahl and Winstead.

11) Ekendahl discloses a method of forming a molded laminated component, which may have a textured surface.

The molding may be carried out purely as mechanical molding (Fig. 3), or purely as vacuum molding (Fig. 4), or as a combination of vacuum molding and partial-area mechanical molding (Fig. 5). In this regard see col. 3, lines 7 to 21 and col. 7, lines 13 to 48. In the method that combines mechanical molding and vacuum molding, <u>the heated laminated component is **first vacuum-molded** onto a one-sided vacuum mold, and **then a mechanical mold plug (50) is pressed** against the laminated component into a mold recess</u> of the vacuum mold during the vacuum molding, in order to form a thinner denser area of the component (col. 7, lines 39 to 48).

There is <u>**no** disclosure or suggestion of carrying out mechanical molding **first**, and **then** pressurized gas molding or even vacuum molding</u> for that matter.

There is also <u>**no** disclosure or suggestion that a **mechanical** molding step shall mold and deform the component **toward but not into contact with** a textured mold surface, and thereafter a</u>

pressurized gas molding step shall **press the component into contact with the textured mold surface**.

Thus, the teachings of Ekendahl would **not** have suggested the presently claimed **combination and sequence of steps c) and e)** whereby a back mold surface first mechanically pre-molds the cover sheet toward the front mold surface, and then a pressurized gas is introduced into a gap between the back mold and the cover sheet to further deform the cover sheet and press it into direct contact with the textured front mold surface.

12) The Examiner has turned to the secondary Winstead reference for a general disclosure that it is known to use "differential air pressure" in a thermoforming process.

Even such general knowledge, when combined with Ekendahl, would not have suggested any relevant features regarding the combination and sequence of molding steps of the present invention. Namely, even if the Ekendahl disclosure is modified in view of Winstead to use **pressurized gas molding** rather than **vacuum molding**, the presently claimed **combination and sequence of steps c) and e)** would **not** have been suggested.

As discussed above, Fig. 5 of Ekendahl relates to a combination of first vacuum molding a laminated component, and then mechanically molding a particular area of the molded component during the ongoing vacuum molding. If that would have been modified to use pressurized gas molding rather than vacuum molding, this still would not have suggested the sequence of first mechanically molding a cover sheet without contacting a

textured mold surface, and thereafter using a pressurized gas to further mold the cover sheet.

Moreover, the combined prior art would not have suggested to use the pressurized gas molding step to press the skin film portion of the cover sheet into direct contact with the textured mold surface, after completion of the prior mechanical pre-molding step.

Thus, even a combination of the applied references further modified with the Examiner's generalized assertion regarding prior art knowledge would still not have suggested the presently claimed combination and sequence of method steps and features.

13) Ekendahl further discloses a step of heating the laminated component before the molding process.

The main goal of Ekendahl is to heat the multi-layered structure uniformly throughout, and especially to heat the **substrate layer** or backing uniformly throughout, **without causing significant heat absorption in the cover layer** or skin film (col. 2, lines 38 to 41; col. 2 line 60 to col. 3 line 1; col. 6 lines 15 to 22, and lines 33 to 37; etc.). Thus, it is a main objective of Ekendahl to predominantly heat the substrate or backing portion of the laminated component without substantially heating the cover layer or skin film portion of the laminated component. That is conceptually essentially the opposite of the present inventive step b) of present claim 36, wherein the cover sheet is differentially heated so as to melt the skin film portion but not melt the backing portion.

Furthermore, there is no suggestion to m lt any portion of the cover sheet in the first place. Ekendahl expressly discloses heating the laminated component and especially the substrate or backing layer to a thermoforming temperature range, which is a range in which the polymeric material is softened and deformable but still in an elastic solid state (col. 2 line 38; col. 6, lines 6 to 22; etc.). For example, the reference book "Engineering with Polymers" by Peter C. Powell, 1983, page 61, Section 4.4.5 "Thermoforming" (**enclosed as Exhibit A**), explains regarding thermoforming precesses that *"the basic process requires an open mould or tool, a means of heating and softening (but not melting!) the sheet in, say, a thermostatically controlled oven, and a means of making the softened sheet conform to the surface of the mould"*. Thus, a person of ordinary skill in the art would understand that the method of Ekendahl expressly maintains the laminated component in a softened **solid** condition and does **not** heat the laminated component sufficiently to **melt** it into a viscous melted **liquid** state.

As pointed out by the Examiner, Ekendahl does not disclose that the substrate or backing layer shall be melted. The Examiner uses such lack of disclosure of melting as positive evidence that the backing layer is not melted. Similarly, Ekendahl does not disclose that the cover layer is melted, which should also be recognized as positive evidence that the cover layer is not melted.

Moreover, Ekendahl expressly discloses that the cover layer is to be subjected to **less** heating than the substrate layer (col. 3, line 1, col. 6 lines 19 to 20; col. 6 lines 33 to 36). Also

Ekendahl discloses that the substrate layer shall be maintained in a softened solid thermoforming temperature range as discussed above. Thus, it must be understood that the cover layer, which is heated less than the substrate, would certainly not be melted into a melted viscous liquid state.

Melting the cover layer or skin film would have been directly contrary to the express teachings and requirements of Ekendahl. Namely, Ekendahl aims to prevent significant heating of the cover layer to avoid scorching, burning or otherwise damaging the cover layer (col. 6 lines 20 to 22 and 35 to 37). Certainly, melting the cover layer into a melted viscous liquid state would be regarding as damaging the cover layer in this context! Furthermore, since Ekendahl provides vacuum molding, this would not have been suitable for use with a melted cover layer, for the reasons discussed above. Namely, the melted liquid cover layer material would have been sucked into the mold vacuum holes.

For the above reasons, the Examiner's generalized assertion that "it is well known to heat a material to equal or above its melting temperature and into a viscous state" would not have been compatible with the express teachings of Ekendahl, and thus would not have motivated a person of ordinary skill in the art to modify Ekendahl in a manner suggesting or achieving the present invention.

14) The secondary Winstead reference has not been applied with respect to melting the skin film portion of a cover sheet, and it includes no relevant teachings in this regard. Winstead is

generally not compatible or combinable with Ekendahl in this context, becaus Winstead expressly aims to avoid a reheating of a sheet material, by forming the material directly following its extrusion while it is still hot and does not need to be reheated.

15) Thus, for the above reasons, Ekendahl viewed in consideration of Winstead and the Examiner's further generalized prior art assertions, would not have suggested the presently claimed step b) of differentially heating the cover sheet so as to <u>melt the skin film portion while maintaining the backing portion in an elastic solid state</u>.

16) The dependent claims recite additional features that further distinguish the invention over the prior art, for example as follows.

Claims 39 to 42 relate to the application of a very light vacuum between the skin film side of the cover sheet and the textured mold surface only after the molding step e), and especially only after the surface texture has been molded into the cover sheet skin film and has at least partially cooled and solidified. Such a post-application of a slight vacuum merely for holding the molded cover sheet in a fixed position has not been disclosed or suggested by the references.

Claim 43 makes clear that the pressurized gas is introduced at a rather high pressure from 1 to 30 bar, which is not a gentle or low pressure typically used for pressurized thermoforming or blow molding, but rather is a sudden shock-like pressure that

very rapidly presses the cover sheet against the textured mold surface.

Claim 47 recites heating the skin film to a temperature of 40 to 70° C higher than the backing portion, which is directly contrary to the teachings of Ekendahl.

Claim 49 recites directly heating the skin film portion with infrared radiation, while tempering the backing portion on a tempered plate. This is also contrary to the teachings of Ekendahl calling for substantial heating of the substrate or backing, without substantial heating of the cover layer or skin film.

Claim 58 is based on original claim 24, which was recognized as containing allowable subject matter.

Claim 61 recites that the gap between he back mold and the cover layer measures no more than 5 mm, which makes clear that this is a rather small gap that can be rapidly filled with the pressurized gas. This is significantly different from typical pressurized thermoforming or blow-molding.

17) For the above reasons, the Examiner is respectfully requested to withdraw the obviousness rejections applying Ekendahl, and Ekendahl in combination with Winstead, because these rejections cannot be applied against any of the present remaining claims.

18) Favorable r consideration and allowance of the application, including all present claims 24 to 30 and 36 to 61 are respectfully requested.

Respectfully submitted,

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Exhibit A: Copy of pg. 61 of "Eng. w. Polymers"

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Contents

complicated shapes can be achieved, notably in heater ductings and petrol tanks for cars.

Not all the parison is used to make the product: the ends which protrude from the closed mould are trimmed off, regranulated, kept clean and recycled. Where the parison is pinched-off or sealed, there will be a long scar where the end of the parison has been removed from the blown product. This will be found on bottles on the base and is in line with the witness mark where the two mould faces meet.

To achieve a satisfactory wall thickness at the thinnest places, the thickness elsewhere may be greater than it needs to be. This limitation of the process is compounded by the moulding being cooled from the outside only (by the co i mould) so that for a given part thickness the cooling cycle is much longer for blow moulding than for injection moulding.

4.4.5 Thermoforming

Thermoforming produces hollow or shaped articles from thermoplastics sheet, and is analogous to sheet metal shaping. Amorphous thermoplastics are preferred because they have a wider range of softening temperatures than partially crystalline ones. The feed is of uniform composition and more expensive than granules or powder because it has already been processed once – by calendering, extrusion or casting. Typical thermoformings include vending cups, chocolate box liners, refrigerator liners, and dinghy hulls.

The basic process requires an open mould or tool, a means of heating and softening (but not melting!) the sheet in, say, a thermostatically controlled oven, and a means of making the softened sheet conform to the surface of the mould. The necessary shaping pressure can be applied using either a simple plunger or by introducing a modest air pressure difference by means of a vacuum or compressed air supply. In vacuum forming, the sheet is clamped over a mould, heated *in situ*, and then shaped by evacuating the air under the sheet in the mould. Shaping results from tensile deformations.

As with blow moulding, the wall thickness of a thermoformed article is not defined precisely by the mould: the dimensions which can be accurately held relate to the surface of the article which is in contact with the mould. For a female mould these are the outside dimensions, and for a male mould the inside ones. The best possible thickness distribution in the final shaping may result from a judicious combination of pressure and vacuum forming, with or without the use of a plunger.

The main attractions are that the equipment is inexpensive, moulds are generally inexpensive (because they do not have to withstand high temperatures and pressures), and large thin-walled parts can be made which could not be produced economically or technically by moulding polymer melts.

There are several disadvantages. Thinning occurs, particularly at corners: this orients material in the direction of draw, and the amount of thinning depends on the drawdown. After shaping and cooling, trimming operations are usually